REMARKS

Further to Applicants' response filed May 22, 2003, claim 1 has been amended. A marked-up version of this claim, showing changes made, is attached hereto as Appendix A. Reconsideration of the above-referenced application in light of the amendment and following remarks is requested.

In the present Amendment, claim 1 has been amended to define in pertinent part a "first and second doping regions being chemically isolated from one another by an inert gas curtain."

The Advisory Action mailed June 9, 2003, asserts that McInerney teaches "two showerheads, 136 and 138, [which] indicate two different processing regions." (Advisory Action, p. 2).

McInerney teaches a first region 116 for depositing a first gas species and a second region 118 for depositing a second gas species. Showerheads 136 and 138 provide two separate gas species for each respective chamber. The function of the first showerhead 136 is to provide a first reactive gas species in a first gas chamber 116, and the second showerhead 138 is to provide a second reactive gas species in a second gas chamber 118. As a result, McInerney is directed to providing a multi-chamber apparatus in which two reactive gas species can be formed on a substrate in two separate chambers. McInerney's apparatus increases throughput. With McInerney's apparatus, incompatible processes can be carried out in separate chambers. There is no motivation to connect showerheads 136 or 138 with "a non-reactive gas species" as recited in claim 47. This would decrease throughput and be contrary to the problem that McInerney is directed to: increasing throughput.

Moreover, the fact that McInerney's showerheads can be utilized in such a manner does not teach or suggest that they can actually be used in that manner. Applicants respectfully submit that the asserted arguments set forth in the Advisory Action represent

an impermissible hindsight reconstruction of the invention. The reconstruction is impermissible because McInerney simply does not teach or suggest connecting a non-reactive gas supply source to either showerheads 136 and 138, nor does McInerney teach or suggest a second reaction chamber for diffusing a first dopant species.

The Advisory Action further asserts that McInerney teaches an inert gas curtain (Advisory Action, p. 2). Applicants respectfully submit that the use of an inert gas in McInerney merely "assists in directing the flow of the reactive gases down into the wells where the reactive gases are drained out." (Col. 11, lines 57-62) (emphasis added). Contrary to the assertion in the Advisory Action, it is not an inert gas curtain. McInerney teaches that "gas flows from highest pressure to lowest pressure . . . [and] are drawn down into respective wells 126 and 128 via annular gaps 126a and 128a." (Col. 5, lines 31-42). "The reactive gases and the inert gas, are drawn into wells 126 and 128 through respective annular gaps 126a and 128." (Fig. 11 and Col. 8, lines 59-66).

In contrast, Applicants' written description provides an explanation of the function of Applicants' inert gas curtain. Applicants' written description provides that "the pressure of the inert gas 360 must be higher than that of the first dopant gas Ax and that of the non-reactive gas By, so that the two doping gases Ax, By are constrained by the gas curtain 300 to remain within their respective reaction chambers." (Applicants' specification, pg. 18, lines 19-21 through pg. 19, lines 1-2) (emphasis added). Accordingly, "gas curtain 300 provides chemical isolation to all adjacent deposition regions." (Applicants' specification, pg. 18, lines 11-12) (emphasis added). Thus, Applicants' inert gas curtain maintains physical separation of the adjacent reaction chambers.

The Advisory Action further asserts that "[o]ne of ordinary skill in the art would recognize that throughput is not the only parameter to be maximized in processing apparatus such as McInerney." (Advisory Action, p. 2). However, this is the primary problem to which McInerney is directed. McInerney teaches an apparatus in which two "incompatible" processes can be performed. One skilled in the art would not use

McInerney's second chamber 118 for diffusion as the Advisory Action asserts. This would decrease throughput and be contrary to the problem that McInerney solves. To increase throughput, as McInerney teaches, one skilled in the art might deposit a first dopant species in the first region 116 and diffuse the dopant species in region 116, and then move the semiconductor wafer into the second region 118 to deposit a second dopant species. It is not logical for one skilled in the art to ignore McInerney's express teachings of depositing a first dopant species in a first region 116 and depositing a second dopant species in a second region 118.

The Advisory Action asserts that Fong uses a second processing region to "drive in dopants." (Advisory Action, p. 2). Applicants respectfully disagree. Fong is directed to providing an apparatus which "enables multiple process steps to be performed in situ in the same chamber to reduce total processing time and to ensure high quality processing." (Col. 7, lines 24-26) (emphasis added). Moreover, one benefit Fong teaches is that "multiple process steps [can] be performed in situ in the same chamber to reduce total processing time . . . [and] also increases the control of the process parameters and reduces device damage," (Abstract). Thus, Fong teaches that multiple steps are to be performed in the same processing region and not a different processing region, as the Advisory Action asserts.

The Advisory Action relies upon Fong's Col. 41, row 61 through Col. 42, row 12 for teaching a second processing region. However, Col. 41 teaches that "[a]fter the deposition of doped dielectric layer 1008, the wafer remains in chamber 15." (Col.41, lines 61-62) (emphasis added). Accordingly, Fong does not teach or suggest a separate processing region to drive in dopants.

Fong teaches multiple processes in the same reaction chamber whereas McInerney is directed to incompatible processes in separate reaction chambers. Still further, using McInerney's second chamber 114 for diffusion would decrease throughput. The addition of a process in a separate chamber would increase the length of time necessary to process the substrate, which is directly against the primary goal of McInerney, increasing

throughput. Moreover, McInerney does not teach an inert gas curtain. Fong does not rectify this deficiency associated with McInerney.

The Advisory Action relies upon Gattuso for teaching an inert gas curtain provided at a pressure somewhat higher than that of the reaction gases within the chamber (Advisory Action, p. 2). What Gattuso actually teaches is that "a significant amount of inert gas within the chamber can interfere with the deposition process." (Page 10, lines 28-30). Thus, Gattuso teaches away from having an inert gas curtain that can interact or co-exist within a reactive chamber. McInerney's argon gas flow, directly interacts and co-exists with reaction chambers 116 and 118 (Figure 3) by assisting the evacuation of the first and second reactive gas species. Thus, one skilled in the art would not be motivated to substitute McInerney's inert argon gas flow with Gattuso's inert gas curtain since Gattuso teaches that it is undesirable for the inert gas to enter the reaction chamber.

The Advisory Action further asserts that since "the gas curtain of McInerney is supplied between each of the stations. It only 'interacts' or 'interferes' to the extent that it separates any gas that may have migrated out of a station. It does not interfere with the deposition process." (Advisory Action, p. 2). The function of the argon gas flow in McInerney is to direct the flow of the reactive gases out of the reaction chambers. Thus, the argon gas flow does interact with McInerney's reaction chambers to assist in evacuating the chambers of reactive gases.

Moreover, McInerney teaches that a pressure gradient must be maintained which serves to remove reactive gases out of chambers 116 and 118. Combining McInerney and Gattuso would produce a system in which an inert gas curtain is provided at a higher pressure than the reactive gases in McInerney's chambers 116 and 118. This would nullify the pressure gradient taught in McInerney. The reactive gases would no longer be exhausted through McInerney's exhaust port 140 since the pressure gradient would no longer exist if a higher pressure inert gas curtain is introduced separating McInerney's chambers 116 and 118.

The Advisory Action asserts that "an inert gas curtain is provided at a location adjacent to the reaction gases to effect separation, the inert gas curtain does not interfere with the vertical pressure gradient formed by downwardly flowing reaction gases it was meant to separate." (Advisory Action, p. 2). However, the argon gas flow in McInerney assists the evacuation of the reactive gases out of the first and second reaction chambers 116, 118 through the exhaust gas port 140. As a result, the only manner in which the argon gas flow can assist in evacuating reactive gases is if a pressure gradient exists for the argon gas flow and the reactive gas species. It would be illogical to provide an argon gas flow that is higher in pressure than the reactive gases when McInerney teaches that the reactive gases are exhausted through a gas port by means of a pressure gradient, e.g., a high to low pressure gradient.

The combination of asserted references does not teach or suggest "a first atomic layer doping region for depositing a first dopant species . . . and a second atomic layer doping region for diffusing said first dopant species," as recited in claim 1 (emphasis added).

Claims 2-17 depend from and incorporate all of the limitations found in independent claim 1, and are similarly allowable along with claim 1 for at least the same reasons provided above with regard to claim 1.

The Advisory Action relies upon Hartig for teaching the use of a separate gas exhaust for each region in a multi-chamber apparatus. There is, however, no motivation to combine Hartig and McInerney. Hartig is directed to providing a multi-chamber coating apparatus for transporting glass slabs. In this manner, "very bulky, especially curved, sheet glass can easily be coated into an adjacent coating chamber without the occurrence of significant gas transfer between the individual chambers." (Col. 1, lines 33-38).

Hartig's apparatus and McInerney's apparatus are different from each other. Hartig's apparatus processes large slabs of glass. In contrast, McInerney's apparatus processes semiconductor wafers. Clearly, this is non-analogous to the wafer processing

described in the McInerney and Fong references and is inherently not combinable with references dealing with glass processes. One skilled in the art would not be motivated to combine the teachings of these references because these two completely different materials require different processing sequences and apparatuses. .

The Advisory Action asserts that "[a]dmittedly, McInerney does not teach separate exhaust ports. However, 'not teaching' a feature is not the same as 'teaching away' from a feature." (Advisory Action, p. 2).

In the present case, however, McInerney does teach away from the claimed invention. McInerney teaches that the "exhaust port 140 [is] located at the bottom of and is fluidically coupled to well 126 and well 128." (Col. 4, lines 59-60) (emphasis added). McInerney's single exhaust port 140 is connected to both reactive chambers 116 and 118, and thus, negates any motivation to provide separate exhaust ports for each reactive chamber. Clearly, McInerney teaches away from separate exhaust ports when McInerney specifically discloses that the exhaust port is fluidically coupled to reaction chambers 116 and 118. Further, there is no motivation to aspirate each chamber as the Advisory Action asserts. There must be some teaching or suggestion in McInerney to use separate exhaust ports. In McInerney, however, there simply is none.

Accordingly, the cited references do not teach or suggest an atomic layer doping apparatus comprising "a first atomic layer doping region for depositing a first dopant gas species . . . said first dopant gas species exhausted through a first gas port, a second atomic layer doping region for diffusing said first dopant gas species with a non-reactive gas species, said first and second doping regions being chemically isolated from one another, wherein said non-reactive gas species is exhausted through a second gas port," as recited by claim 47.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

By_____

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APPENDIX A

1. (amended) An atomic layer doping apparatus comprising:

a first atomic layer doping region for depositing a first dopant species on a first substrate as [a] an atomic monolayer;

a second atomic layer doping region for diffusing said first dopant species in said first substrate, said first and second doping regions being chemically isolated from one another by an inert gas curtain; and

a loading assembly for moving said first substrate from said first doping region to said second doping region, thereby enabling deposition of a first atomic monolayer in said first doping region, followed by diffusion of said first atomic monolayer in said second doping region.